

SECTION V. MAINTENANCE

8.5.1 INTRODUCTION

This section provides the preventive and corrective maintenance procedures for the ASOS pressure sensor. Preventive maintenance consists of checking and cleaning the pressure sensor and verifying the accuracy of pressure sensor data. Corrective maintenance consists of the procedures required to troubleshoot and fault isolate the pressure sensor. This section also provides the procedures to remove and install a pressure sensor, to turn on pressure sensor report processing, and to clear pressure sensor data quality failures.

8.5.2 PREVENTIVE MAINTENANCE

8.5.2.1 **General.** A list of the pressure sensor preventive maintenance functions is provided in table 8.5.1.

Table 8.5.1. Pressure Sensor Preventive Maintenance Schedule

Interval	What To Do	How To Do It
90 days	Clean and inspect pressure sensor. Check DCP/SCA desiccant. Verify accuracy of pressure sensor data.	Paragraph 8.5.2.2 Paragraph 3.5.2.1, 14.5.2.1 Paragraph 8.5.2.3

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8.5.2.2 **Pressure Sensor Cleaning and Inspection.** Pressure sensor accuracy relies on the tygon tubing from the sensors to the PRESSURE VENT inlets. At some sites, external copper tubing may also be used to vent the PRESSURE VENT to the outdoor environment. For proper performance, all tubing must be clear of obstructions and not be crimped or pinched by any other structures. All pressure vent tubing must be visually inspected to ensure that there is no foreign matter in the tube and that the tube is not pinched or cut. Any damaged tubing must be replaced. The DCP and SCA use desiccant dryers. Refer to paragraphs 3.5.2.1 and 14.5.2.1 respectively for desiccant dryer information. The drawer should also be cleaned to remove any dirt or dust that may be present.

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8.5.2.3 **Verifying Accuracy of Pressure Sensor Data.** A technician must verify the accuracy of data from the pressure sensors as follows:

- a. Every 90 days
- b. Whenever pressure sensor report processing has been turned off (paragraph 8.5.5)
- c. Whenever a pressure sensor data quality failure has occurred (paragraph 8.5.6)
- d. After performing pressure sensor corrective maintenance (troubleshooting, replacing a pressure sensor, etc)

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Pressure sensor data are verified by comparing pressure sensor output data (as shown on the sensor status page at the OID) against a calibrated portable pressure standard. Table 8.5.2 provides procedures to verify output data from the pressure sensors.

8.5.2.3.1 **Use of the Portable Pressure Standard.** The portable pressure standard used with ASOS is Paroscientific model 760-16B, part number 1107-101. This portable pressure standard incorporates a 6-volt, 3 ampere-hour sealed lead acid battery for portable operation. Some characteristics of the battery circuit and operation of the portable pressure standard are listed below.

- a. A nominal charge for the battery is 6.3 to 6.7 volts.
- b. The expected life of the battery is 100 hours between charges.

CAUTION

The portable pressure standard must not be used when a low battery indication is given. Readings may continue to be taken if the portable pressure standard is plugged into an ac power outlet. The battery will also be charged during this period.

- c. A low battery voltage (i.e., 5.1 volts) is indicated by decimals being placed after each numeric digit being displayed.

(1) Example of a good reading: 14.4567 psi

(2) Example of a low voltage display reading: 1.4.4.5.6.7

- d. The model 760-16B portable pressure standard charges at a controlled rate up to 180 mA. A partially discharged battery (5.1-volt low battery) takes approximately 6 to 8 hours to become fully charged.
- e. A fully discharged battery (0 to 3 volts) may not necessarily recover when charged. In this case, the LCD display shows a series of dashes. If the battery does not accept a charge, the portable pressure standard is to be returned to the pressure laboratory at the address listed below:

National Weather Service
1325 East/West Highway
Silver Spring, MD 20910
RM 2378 Attn: Bernard Morningstar

All units being returned must be shipped Federal Express Overnight.

- f. The charging circuit is on when the portable pressure standard is plugged into an ac power outlet. The ON/OFF switch does not have to be ON.
- g. The LCD power-on sequence with a fully charged battery goes through a stage where all LCD segments are ON (8.8:8.8:8.8), then OFF ----, then the pressure reading is displayed.
- h. The front panel ZERO SET switch is actually a mathematical TARE switch. This means that a software zero will be set for the portable pressure standard. When switched ON, it reads the pressure displayed and subtracts that amount from subsequent measurements. The display then indicates the difference from the original value. When the ZERO SET switch is switched OFF, this function is disabled. For use with ASOS, the ZERO SET switch must be left in the OFF position before turning the standard on.

8.5.3 CORRECTIVE MAINTENANCE

8.5.3.1 Introduction. Corrective maintenance consists of fault isolation and removal and replacement of faulty pressure sensors. The pressure sensors are considered critical reporting items. For this reason, corrective maintenance for a pressure sensor typically generates a data quality failure, which essentially takes the sensor off-line. The system WILL NOT automatically clear the data quality failure following the maintenance action. The technician MUST use a portable pressure standard to verify the accuracy of pressure sensor data (paragraph 8.5.2.3), then manually clear the data quality failure (paragraph 8.5.6) before the system will place the sensor back on-line.

8.5.3.2 Troubleshooting. Troubleshooting the pressure sensors consists of isolating faults to a particular pressure sensor, the internal plastic (and, at some sites, external copper) sensor tubing, power to the sensor, or the serial input/output (SIO) interfaces to the sensors. The pressure sensor maintenance page (Chapter 1, Section III) indicates when the corresponding sensor fails the sensor response check and the system data quality check. A sensor response failure indicates a pressure sensor power failure or an SIO interface failure. The ac/dc power distribution description in Chapter 2 (ACU), Chapter 3 (DCP), or Chapter 14 for SCA provides pressure sensor power troubleshooting information. The pressure sensor and SIO descriptions in Chapter 2 (ACU), Chapter 3 (DCP), or Chapter 14 for SCA describe troubleshooting pressure sensor SIO interfaces. A data quality failure may indicate that the sensor is reporting data that are out of tolerance with the other pressure sensors in the system (paragraph 8.5.6) and should therefore be replaced.

Table 8.5.2. Verifying Accuracy of Pressure Sensor Data

Step	Procedure
	<p>Tools required: Portable pressure standard</p> <p>CAUTION</p> <p>The portable pressure standard LCD display will freeze at temperatures below 15°F (-10°C). When using the pressure standard outdoors in a cold climate, ensure that the pressure standard is placed in a location that will prevent the LCD from freezing.</p>
1	<p>Open portable pressure standard and remove cap from PRESSURE INPUT port. Ensure that ZERO SET switch is in OFF position. Position pressure standard near cabinet, at same elevation as pressure sensor.</p> <p>CAUTION</p> <p>Do not use portable pressure standard on battery power when a low battery indication is given (decimals or dashes on LCD display). In such cases, pressure standard may be used if plugged into an ac outlet (standard also recharges during this period).</p>
2	Turn on portable pressure standard. If standard is at room temperature, allow approximately 5 minutes for portable pressure standard to stabilize. If standard is not at room temperature, allow it to warm up before proceeding.
3	If PRESSURE VENT on I/O Connector Panel 1A9 (at rear of ACU cabinet) is vented to outside by copper tubing, perform steps 4 through 6. If PRESSURE VENT is not vented or if sensor is installed in the DCP or SCA, proceed to step 7.
4	At OID, display sensor status page (sequentially press REVIEW-SENSR-STAT function keys from 1-minute screen).
5	On sensor status page, set report processing for pressure sensors to OFF.
6	Disconnect outside vent tubing from PRESSURE VENT inlet of I/O Control Panel 1A9.
7	At OID, display second page (shows pressure data) of sensor 12-hour set (sequentially press REVUE-SENSR-12HR-PAGE function keys from 1-minute screen).
8	On 12-hour page, compare most recent reading for pressure sensors 1, 2, and 3 (if applicable) with value displayed on portable pressure standard.

Table 8.5.2. Verifying Accuracy of Pressure Sensor Data -CONT

Step	Procedure
9	Ensure that all sensor values are within ± 0.020 of the value on the portable pressure standard. If individual sensor is out of tolerance, replace sensor. If all sensors are out of tolerance (by the same amount), inspect and clear all pressure sensor vent tubing and recheck. If all sensors are still out of tolerance, portable pressure sensor may be out of calibration.
10	If external copper vent tubing was previously disconnected, connect external tubing to PRESSURE VENT inlet on I/O Connector Panel 1A9.
11	Turn pressure sensor report processing on in accordance with table 8.5.4.
12	Turn off portable pressure standard, install cap on PRESSURE INPUT port, and install lid.

8.5.4 PRESSURE SENSOR REMOVAL AND INSTALLATION

The replacement of a faulty pressure transducer is easily accomplished using simple handtools. When a pressure sensor is replaced, the loss of sensor data results in a data quality failure for that sensor. Before the system places the new sensor on-line, the technician **MUST** use a portable pressure standard to verify the accuracy of the new sensor (paragraph 8.5.2.3) and clear the data quality failure (paragraph 8.5.6). The procedures required to remove and install a pressure sensor are provided in table 8.5.3.

8.5.5 PRESSURE SENSOR REPORT PROCESSING PROCEDURES

Report processing for the pressure sensors may be turned off in one of two ways:

- a. Like other sensors, report processing for pressure sensors may be turned off (from OID sensor status page) by an observer, air traffic controller, technician, or system manager.
- b. Unlike other sensors, the system automatically turns off report processing for the pressure sensors whenever an observer edits the ALTIMETER field on the 1-minute screen.

Whenever pressure sensor report processing is off (for either reason), the system assumes that the pressure data may not be accurate and therefore should not be used. The system then allows only a technician to turn back on pressure sensor report processing. Before turning pressure sensors report processing on, the technician **MUST** use a portable pressure standard to verify that pressure sensors are providing accurate data (paragraph 8.5.2.3). Table 8.5.4 provides procedures to turn on pressure sensor report processing.

8.5.6 CLEARING PRESSURE SENSOR DATA QUALITY FAILURES

ASOS software performs the following two data quality checks against the data received by the pressure sensors. Data quality failures, when they occur, are indicated on the maintenance page for the failing sensor (Chapter 1, Section III) and on the sensor status page (REVUE-SENSR-STAT).

- a. A data quality failure occurs if the data from one pressure sensor is more than ± 0.040 inHg apart from the other(s). In a system with three pressure sensors, the out-of-tolerance sensor is logged as a data quality failure. In a system with two pressure sensors, it is impossible to determine which of the two is out of tolerance, so the system logs both as data quality failures.
- b. Each pressure sensor is polled for data once every 10 seconds. If a pressure sensor fails to respond more than once in a 1-minute period or fails to respond more than twice in a 12-hour period, a data quality failure is logged for that sensor. Because corrective maintenance tasks such as troubleshooting or replacing a pressure sensor require longer than 20 seconds, such tasks typically generate data quality failures.

8.5.6.1 Effect of Data Quality Failures on Altimeter Report. If a data quality failure occurs in a system with only two pressure sensors, the ASOS stops reporting altimeter settings (altimeter goes missing). In a three-sensor system, a single data quality failure does not interrupt altimeter reporting. The ASOS continues to report altimeter settings based on the data from the two remaining pressure sensors.

8.5.6.2 Clearing Pressure Sensor Data Quality Failures. For other ASOS sensors (visibility, ceilometer, etc.), the system automatically clears data quality failures after the sensor reports a sufficient number of valid data samples. The pressure sensors, because they are critical to aircraft safety, require the technician to take a positive action to clear the data quality failure and bring the sensor on-line. This is achieved by deconfiguring and reconfiguring the pressure sensor from the sensor configuration page (paragraph 1.3.16.2) of the OID. Prior to this action, however, the technician **MUST** use a portable pressure standard to verify that the sensor is reporting accurate data (as described in paragraph 8.5.2.3). Table 8.5.5 provides procedures to clear a pressure sensor data quality failure by deconfiguring and reconfiguring the sensor.

Table 8.5.3. Pressure Sensor Removal and Installation

Step	Procedure
REMOVAL	
Tools required: Large flat-tipped screwdriver Small flat-tipped screwdriver No. 2 Phillips screwdriver	
<u>WARNING</u>	
Pressure sensors are safety-critical devices. Pressure sensors may output erroneous readings if damaged or if plastic vent tubing is damaged or obstructed. Throughout this procedure, exercise caution to avoid damage to pressure sensors and vent tubing.	
NOTE	
Internal threshold detectors were built into pressure sensors with serial numbers 358495, 358509, and 363914 and above. Other sensors modified with internal detectors are labeled as such. All other sensors, when used on Class I systems, require external threshold detectors.	
	NOTE In the DCP and SCA, the pressure mounting shelf is not secured. Proceed to step 2.
1	Using large flat-tipped screwdriver, remove four screws, lockwashers, and flat washers securing rf/pressure mounting shelf slide mount to frame.
2	Slide mounting shelf out until slides lock in fully extended position.
3	Locate pressure sensor to be removed.
4	Using small flat-tipped screwdriver, remove power and signal cables from pressure sensor.
5	Disconnect pressure sensor tube from pressure sensor.
6	Using Phillips screwdriver, remove four screws, lockwashers, and flat washers securing pressure sensor to shelf. Remove pressure sensor.
7	If pressure sensor is equipped with an external threshold detector, disconnect detector from sensor. Pack and ship detector in container with sensor.

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Table 8.5.3. Pressure Sensor Removal and Installation -CONT

Step	Procedure
INSTALLATION	
Tools required: Large flat-tipped screwdriver No. 2 Phillips screwdriver Small flat-tipped screwdriver	
<div style="text-align: center;"><u>WARNING</u></div> <p>Pressure sensors are safety-critical devices. Pressure sensors may output erroneous readings if damaged or if plastic vent tubing is damaged or obstructed. Throughout this procedure, exercise caution to avoid damage to pressure sensors and vent tubing.</p> <div style="text-align: center;">NOTE</div> <p>Internal threshold detectors were built into pressure sensors with serial numbers 358495, 358509, and 363914 and above. Other sensors modified with internal detectors are labeled as such. All other sensors, when used on Class I systems, require external threshold detectors.</p> <p>In the DCP and SCA, the pressure mounting shelf is not secured. Proceed to step 2.</p>	
1	Slide mounting shelf out until slides lock in fully extended position. <div style="text-align: center;">NOTE</div> <p>If installing pressure sensor on a Class I system, ensure that replacement sensor is equipped with an undervoltage threshold detector (internal or external).</p> <p>If replacement sensor requires an external threshold detector, install detector onto pressure sensor power connector (J2).</p>
2	Position pressure sensor over four mounting holes in mounting shelf. Using Phillips screwdriver, install four screws, lockwashers, and flat washers securing pressure sensor to shelf.
3	Using small flat-tipped screwdriver, install power and signal cables to pressure sensor.
4	Connect pressure sensor tube to pressure sensor. <div style="text-align: center;"><u>WARNING</u></div> <p>Pressure sensors may output erroneous values if plastic vent tubing binds or crimps when shelf is closed. Exercise caution when closing shelf to prevent damage to pressure sensor vent tubing.</p>
5	<div style="text-align: center;">NOTE</div> <p>In the DCP and SCA, the pressure mounting shelf is not secured. Proceed to step 7.</p> <p>While taking care not to damage or crimp pressure sensor vent tubing, release mounting shelf slide locks and push mounting shelf back into cabinet. After closing shelf, ensure that pressure tubing is properly connected to PRESSURE VENT on ACU I/O Panel Assembly 1A9 and is not damaged or crimped.</p>
6	Using large flat-tipped screwdriver, install four screws, lockwashers, and flat washers securing mounting shelf to frame (ACU only).
<div style="text-align: center;"><u>WARNING</u></div> <p>Accuracy of pressure sensor data is critical to aircraft safety. Technician must verify the accuracy of pressure sensor data after installing pressure sensor.</p>	
7	Verify accuracy of data from all pressure sensors in accordance with table 8.5.2.
8	At OID, display sensor status page (sequentially press REVUE-SENSR-STAT function keys from 1-minute screen).
9	Check DATA QUALITY status of pressure sensor just installed. If status is F (fail), clear data quality failure in accordance with table 8.5.5.

Table 8.5.4. Turning Pressure Sensor Report Processing On

Step	Procedure
<p style="text-align: center;"><u>WARNING</u></p> <p>Accuracy of pressure sensor data is critical to aircraft safety. Technician must verify the accuracy of pressure sensor data before turning pressure sensor report processing on.</p>	
1	Verify the accuracy of data from all pressure sensors in accordance with table 8.5.2.
2	At OID, display sensor status page (sequentially press REVUE-SENSR-STAT function keys from 1-minute screen).
3	Using PREV and NEXT keys, move cursor to select one of the pressure sensors.
4	Press PROC function key. Message SYSTEM MODIFICATIONS flashes at top of screen and system prompts for technician to enter initials.
5	Enter two- or three-character initials. After entering initials, RPT PROC field for all pressure sensors changes to ON and SYSTEM MODIFICATION message is removed.
6	Press EXIT to return to 1-minute screen. System begins reporting ALTIMETER data within 1 minute (provided that at least two pressure sensors have report processing on and pass data quality verification).

Table 8.5.5. Clearing Pressure Sensor Data Quality Failures

Step	Procedure
SENSOR DECONFIGURATION	
<p style="text-align: center;"><u>WARNING</u></p> <p>Accuracy of pressure sensor data is critical to aircraft safety. Technician must verify the accuracy of pressure sensor data before clearing data quality failure.</p>	
1	Verify accuracy of data from all pressure sensors in accordance with table 8.5.2.
2	At OID, display sensor status page (sequentially press REVUE-SENSR-STAT function keys from 1-minute screen).
3	From sensor status page, determine which pressure sensor (#1, #2, or #3) has data quality failure.
4	At OID, display sensor configuration page (sequentially press REVUE-SITE-CONFIG-SENSR function keys from 1-minute screen).
5	On sensor configuration page, press CHANG key. A cursor is displayed and message SYSTEM MODIFICATIONS flashes at top of screen.
6	Using PREV and NEXT keys, move cursor to highlight code (P1, P2, or P3) for pressure sensor with data quality failure.
7	To deconfigure sensor, enter two asterisks (**) in place of highlighted sensor code.
8	Press BACK key. Cursor and SYSTEM MODIFICATIONS message are removed from screen.
9	Press EXIT key to return to 1-minute screen and cause system to accept change.
SENSOR RECONFIGURATION	
1	At OID, again display sensor configuration page (sequentially press REVUE-SITE-CONFIG-SENSR keys).
2	On sensor configuration page, press CHANG key. Cursor is displayed and message SYSTEM MODIFICATIONS flashes at top of screen.
3	Using PREV and NEXT keys, move cursor to highlight asterisks (**) entered when sensor was deconfigured.
4	To reconfigure sensor, enter two-character code (P1, P2, or P3) for pressure sensor in place of asterisks.

Table 8.5.5. Clearing Pressure Sensor Data Quality Failures -CONT

Step	Procedure
5	Press BACK key. Cursor and SYSTEM MODIFICATIONS message are removed from screen.
6	Press EXIT key to return to 1-minute screen and cause system to accept change.
7	Display sensor status page (sequentially press REVUE-SENSR-STAT function keys from 1-minute screen). Verify that data quality field shows pass status for pressure sensor just reconfigured (within 2 minutes).
8	Press exit to return to 1-minute screen. System begins reporting ALTIMETER data within 4 minutes after reconfiguring (provided that at least two pressure sensors have report processing on and pass data quality verification).